



U. S. DEPARTMENT OF AGRICULTURE.

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REPORT

OF

THE CHIEF OF THE DIVISION OF MICROSCOPY

FOR

1893.

BY

THOMAS TAYLOR, M. D.

FROM THE REPORT OF THE SECRETARY OF AGRICULTURE FOR 1893.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.

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REPORT OF THE CHIEF OF THE DIVISION OF MICROSCOPY.

SIR: I have the honor to submit herewith my annual report on the work of the Division of Microscopy for the year 1893.

Very respectfully,

THOMAS TAYLOR,
Chief.

Hon. J. STERLING MORTON,
Secretary.

WORK OF THE YEAR.

EXHIBIT OF THE DIVISION AT THE WORLD'S FAIR.

The numerous and constant demands, both by correspondence and by personal inquiry, for information in regard to mushrooms, including not only methods of cultivation but the means of identifying the various species found in field and forest, indicated so widespread an interest in this subject that it was deemed advisable to prepare for the World's Columbian Exposition at Chicago an exhibit which should illustrate, by models, as many of the leading genera and species of the edible and non-edible mushrooms of the United States as could be collected.

In connection with the exhibit a catalogue has been prepared, which describes each species represented. This undertaking necessitated a large amount of correspondence and divisional field work, as well as a personal supervision of the details of the exhibit. There was also prepared an exhibit consisting of the instruments of precision used in the routine work of the division, and of a series of magnifications of microphotographs showing the characteristic crystallizations of animal and vegetable fats. Aside from this, the division was represented in the cotton exhibit of the United States Government by a large selection of types of foreign and domestic cotton, collected for the division by the cotton exchanges of this country and Liverpool, England. The entire exhibit of the division covered a space of over 500 square feet. The mushroom exhibit is now installed in the museum of this Department.

Cordial acknowledgments are due to agricultural experiment stations and other collectors from whom have been received specimens of the mushrooms of their respective localities; also, to the National Museum for specimens of various animal fats.

A MUSHROOM HERBARIUM.

As an aid to the identification of species and as a means of facilitating exchanges of specimens, it has long been desired to form a herbarium which should comprise such species of mushrooms as admit of

preservation for that purpose; but until within the last few months the division has been so cramped for room as to render it impossible to preserve a large number of specimens for any length of time. However, several hundred plants, representing many edible and poisonous varieties, have been preserved partly by drying and partly in alcohol; and since the division has been installed in its present more roomy quarters, the nucleus of a herbarium has been formed, which is at present augmented by the loan, by Dr. T. A. Taylor, formerly of the District of Columbia but now of Omaha, Nebr., of a collection consisting of several thousand dried specimens, chiefly the Hymenomycetes, in which are included most of the fleshy mushrooms.

MICROSCOPICAL INVESTIGATIONS.

Microscopical investigations have been made of suspected butters, lard, oleomargarine, milk, olive oils, etc., as requested from time to time by the public.

Samples of the teas of India, Ceylon, Russia, and Japan, and coffee from Costa Rica, have been secured from the various commissioners from these countries at the Exposition at Chicago. These samples are valuable for use in contrast when examining such teas and coffees on the market as are suspected of adulteration. Samples of animal and seed oils of many varieties have also been obtained from Russia, Japan, Ceylon, Spain, Turkey, Australia, Trinidad, Liberia, Costa Rica, and the Argentine Republic, together with twelve samples of native olive oils from California. These pure oils from original sources are of special value, as types of reference, in pursuing the micro-chemical investigation of the adulterations of the medicinal and food fats, already successfully inaugurated in this division.

INVESTIGATION OF THE COTTON STAPLE OF THE UNITED STATES.

For the purpose of conducting an investigation of the cotton staple of the United States the division has been furnished with 141 samples of cotton from reliable sources, principally from experts connected with the cotton exchanges of New Orleans, Texas, Savannah, and Liverpool, England. The samples from Liverpool represent all the more important cotton-growing countries exclusive of the United States. Nearly 3,000 measurements have been taken, averaging generally 20 to the sample, giving the maximum, minimum, and mean length of the fibers of the sample.

MEASUREMENT OF COTTON FIBERS.

Each individual hair of cotton seed is known commercially as a cotton fiber. As seen under the microscope each such hair has a blunt point, the natural termination of the fiber, differing from its opposite extremity, which shows the fracture occasioned in picking and ginning. We proceed to measure by first mixing and pulling apart loosely a few ounces of cotton, drawing out of this at random one fiber and placing it upon a glass slide previously moistened with a little weak gum water. The fiber is then gently and carefully smoothed with a camel's hair pencil and the fingers until straight. This is accomplished under a dissecting microscope with low powers.

When straightened, the fiber is viewed with the compound microscope, using a magnifying power of about 400 diameters, in order to ascertain

whether its natural point is present. If wanting, which is exceptional, the fiber is discarded. A glass micrometer $2\frac{1}{2}$ inches long, divided into thirty-secondths of an inch, the lines ruled so as to be visible through the glass, is then placed over the slide holding the fiber, and its length ascertained by close and careful inspection. It will be seen in the above explanation that only fibers which show a terminal point are measured. This criterion for measurement was adopted after testing the results upon individual fibers of the method in use among cotton experts. They have a rough method of determining the length of the fiber in a given sample, viz, by taking a bunch of the cotton firmly between the thumbs and forefingers of both hands and pulling it apart with great force, passing layer over layer repeatedly until the fibers are fairly even. The sample is then laid on the coat sleeve for convenience and its length taken with a pocket rule. This hasty method results in a breakage of about 50 per cent of the individual fibers, the microscope showing that after the violent process described about that proportion exhibit fracture at both ends, whereas the fiber as delivered from the gin ordinarily, as has been shown, shows fracture at but one end, especially where the roller gin is employed.

The method adopted is to ascertain, first, that the fiber is a proper subject for measurement, and then to take the average length of a given number of fibers in each sample. The number of linear measurements having been made, the next step is to ascertain the width, twist, elasticity, and tensile strength. The names of growers and measurements of samples thus far examined are withheld, lest injustice should be done other cotton-planters whose samples have not yet been measured. It is the purpose to compare the staple of this country with that of foreign countries, noting what changes, if any, occur in cotton raised from American seed on foreign soil, especially as regards Sea Island staple, observing also whether Egyptian seed grown in this country produces a staple of similar grade to that produced in Egypt.

The prosecution of this investigation of cotton staple will constitute an important feature of the divisional work of the year 1894. The measurements of cotton already effected are but a small proportion of the work to be done.

FOUR EDIBLE MUSHROOMS.

RUSSULA VIRESCENS Fr.

(Edible.)

A considerable number of this species were collected in Prince George County, Md., during the months of June and July. Our experience as regards color, structure, and habitat of this mushroom agrees with that of Prof. Peck, who describes it under the name of *Russula virescens* Fr., as follows:

According to the description of this species, the margin of the pileus should be even, but specimens occur sometimes in which the margin is wholly or partly striate. The number of forked and intermediate lamellæ is also variable, and the "warts" are sometimes pale brown instead of green. The color of the pileus is generally grayish green, but is frequently tinged with yellow.

The term "warts" used in this connection refers merely to the patches resulting from the splitting or breaking of the epidermis of the cap, and not to such excrescences, called "warts," as are commonly observed

on the cap of *Amanita muscarius*, for example, which are portions of the volva. A trial cultivation of this species is recommended. It has been found growing in Maryland from June to November, but hitherto seems to have attracted but little attention in this country as an edible species, although highly esteemed in Europe, and according to some authorities susceptible of cultivation. The peasants in the neighborhood of Milan are in the habit of toasting these mushrooms over wood embers, eating them afterwards with a little salt. The light green color of the top, resembling the pigment "terre verte," may have caused some distrust as to the edibility of this species, but special attention is called to it as one of the most desirable mushrooms we have for food.

EXPLANATION OF PLATE I.

Plate I exhibits four views of this mushroom drawn and colored from nature. Fig. 1, the immature plant; Fig. 2, advanced stage of growth, cap expanded or plane; Fig. 3, section showing the unequal length of the gills and manner of their attachment to the stem; Fig. 4, surface view of the pileus, showing a slightly umbilicate tendency in maturity and the epidermis split in characteristic irregular patches; Fig. 5, spores white.

COPRINUS COMATUS Fr.

(Edible.)

This species, *Coprinus comatus*, is found in abundance in the United States, in rich soil, usually in the fall months. It was offered for sale for the first time during the present season in Center Market, Washington, D. C., bringing 25 cents per pound. This species is highly esteemed, especially for catchups, for which it is largely used in England when there happens to be a dearth of *Agaricus arvensis*, or the "horse" mushroom. Prof. Peck describes our American species thus:

Pileus thin, cylindrical, then campanulate, rough, with broad, rather distant, fibrous scales, whitish, margin soon discolored, revolute and lacerated; lamellæ linear, crowded, free, white, then pink, finally black; stipe nearly equal, fibrillose, hollow, annulate, the annulus or ring movable; the cavity of the stem containing a gossamer-like web.

EXPLANATION OF PLATE II.

Plate II represents a fragile and perishable species, the gills of which soon dissolve into an inky fluid, by which feature the genus is readily identified. In the plate Fig. 1 shows the very young plant; Fig. 2, stage of growth in which the cap begins to expand, exposing the tender pink of the gills; Fig. 3, mature plant, bell-shaped and "maned," with movable ring detached from the pileus, and with stem unequal and rooting; Fig. 4, sectional view, showing hollow stem, thin cap, and broad, free, linear gill; Fig. 5, spores black.

MARASMIUS OREADES Fr. "Fairy Ring Mushroom."

(Edible.)

This mushroom, found in hedges and orchards from May to October, belongs to a non-putrescent genus and dries readily. The cap of *Marasmius oreades* is of a pale ochreous tint, shaded sometimes with rufous or reddish brown. Stem and gills are of the same color.

This species is described by Prof. Peck as follows:

Pileus fleshy, firm, smooth, convex, then expanded, often irregular and broadly subumbonate, watery, fulvous when moist, whitish or cream-colored when dry; lamellæ broad, distant, free, whitish or cream-colored; stipe equal, smooth, solid, sometimes rooting. I have never seen it forming a complete ring, but it often forms a part of one.



L. Krieger, Pinx.

RUSSULA VIRESCENS, FR. (EDIBLE)
The Verdette. From Nature.
Collected in the District of Columbia.

AVIL CO. LITH. PHILA.



L. Krieger Pinx.

AVIL CO. LITH. PHILA.

COPRINUS COMATUS FR. (EDIBLE)
The Maned Mushroom, from Nature.
Collected in the District of Columbia.



MARASMIUS OREADES FR. (EDIBLE)
The Fairy Ring Mushroom.



A. (HYPHOLOMA) SUBLATERITIUS Schaeff.
Edible. Collected in the State of Maryland.

FIG.4.

FIG.1.

FIG.5.

X 450.

FIG.2.

FIG.3.

EDIBLE.

L. KRIEGER, PINX.

AGARICUS SUBRUFESCENS. PECK.

DRAWN FROM NATURE.

EXPLANATION ON PLATE III.

In Plate III Fig. 1 represents an immature plant; Fig. 2, cap expanding with growth; Fig. 3, cap further expanded and slightly umbonate; Fig. 4, mature specimen, cap plane or fully expanded, margin irregular and smooth, stem equal, smooth, and ringless; Fig. 5, sections showing gills broad, free, ventricose, unequal, and flesh white; Fig. 6, spores white.

AGARICUS (Hypholoma) SUBLATERITIUS Schæff.

(Edible.)

Some of the older authors deemed this a poisonous mushroom, but it has been frequently eaten by the writer and others in quantity without bad effects. This species is very plentiful in Prince George County, Md., where a stump measuring from 3 to 4 feet in height literally covered with these mushrooms was recently observed. They grow in pine and oak woods in groups of 50 or more, and are generally found on rotting tree stumps.

EXPLANATION OF PLATE IV.

This plate represents a group of wild, edible mushrooms, found in great abundance in the fall of the year and even as late as January, frequently in such dense clusters that only their caps can be observed.

The cap of *Agaricus sublateritius* is of a brick-red color, with edges pale straw. Gills at first a dirty white, turning in advanced age to a dark olive green. The stem tapers downward, and within an inch of its attachment to the cap is of a very light straw color. Towards the root it is covered with patches and lines of burnt sienna color. Uncooked it has sometimes a slightly bitter taste, which disappears when it is stewed with butter, pepper, and salt.

CRYSTALLIZATIONS OF SEED-OIL FATS AND ANIMAL FATS.

Recent investigations demonstrate that the crystalline forms of the animal and vegetable fats differ materially. To illustrate this in some degree, two plates of vegetable fats are submitted in contrast with one plate of animal fats. To obtain crystals of the fatty glycerides of animal fats, the melted fat should cool gradually for about ten hours in a temperature of about 65° F., in order to get the fully developed crystallization. The fat of plants will crystallize within as many minutes.

CHIAULMUGRA FAT (extracted from the seeds of *Gynocardia odorata* R. Br.).

For the purpose of securing interesting and beautiful groupings of the crystals of seed fats, the method here outlined must be strictly followed; otherwise, some of the forms illustrated can not be obtained. The solid fat used in the production of the crystals seen in Plate V, Fig. 1, was secured from the oil of chaulmugra seed. (For further information concerning the medicinal properties of this seed oil see No. 29 of the Imperial Institute Series, published by the Indian department of revenue and agriculture.) In preparing chaulmugra fat for micro-photography put a small portion of it on a microscopical slide, placing over it a glass cover such as is used in general mounting. Heat the slide over a spirit lamp until the fat melts—do not overheat—and allow it to cool in a temperature of about 60° F. Within a few minutes the mount will appear white, owing to the crystallization of the fat. The slide is now ready for observation under the microscope. The same slide may be reheated and allowed to cool, giving similar results. Although various crystallizations of this fat are obtained, all exhibit sameness of minutiae

of crystallization. It is found that heating chaulmugra fat to the fuming point causes, it would seem, a dissipation of some volatile glyceride, thereby changing the crystallization; therefore, this fat should not be submitted to fuming heat, as is the method with the animal fats.

COCOANUT OIL.

Plate V, Fig. 2, represents an oil from Colombo, Ceylon, derived from the seeds of a species of palm known botanically as *Cocos nucifera*. The oil which is obtained from the seeds, either by hot pressure or by boiling the seeds in water, is of a butyraceous consistency, white, and of rather a peculiar odor. The extensive geographical distribution of this tree is accounted for by the fact of the tree growing in such close proximity to the sea that the ripe fruit, falling on the beach, is washed away by the waves and afterwards cast upon distant shores, where it readily vegetates. It has been said that in this way the coral islands have become covered with these palms. It is also worthy of remark that the triangular form of the fruit facilitates its progress through the waves.

CARAPA, OR "CRAB" OIL FAT.

Carapa or "crab" oil is expressed from the seeds of a tree native to tropical America, the West Indies, and Guinea. Plate VI, Fig. 1, represents the crystallizations peculiar to "crab" oil fat. The sample of oil from which the fat was extracted for the illustration came from the island of Trinidad. The oil is suitable for illuminating purposes, and, it is said, is also used by the natives of tropical regions to anoint the hair. In cool temperatures this oil hardens into a solid fat. Botanically, the tree from which this oil is obtained is known as *Carapa guianensis* Aub.

"PALM-OIL" FAT.

Plate VI, Fig. 2, represents the crystallized fat of "palm oil," obtained from the seeds of a species of palm tree native to western tropical Africa, *Elais guineensis*. The sample was received directly from Liberia, on the coast of Africa.

ANIMAL FATS.

Plate VII represents six animal fats, including one view of human fat. Fig. 1 represents the crystallization of cow's-butter fat. This smooth, rounded form is very frequently met with in testing butter of the Short-horn breed of cows. Fig. 2 represents the forms very frequently observed in butter from the Jersey breed; the crystallizations generally exhibit an uneven outline. Fig. 4 shows the crystallizations of a butter from a cross-breed of Jersey and Shorthorn; Fig. 3, muskrat-fat crystals; Fig. 5, human-fat crystals; Fig. 6, fat crystals of a monkey which died of consumption. Several fats of this tribe received from the National Museum, recently tested, including the fat of an ourang-outang, yielded the same characteristic crystals (stearin). It has been found that stearin is a less soluble fat than palmitin, hence it seems probable that palmitin is more readily absorbed at a high temperature of the blood, than stearin. (See Fig. 6.)

CHAULMUGRA FAT CRYSTALS.



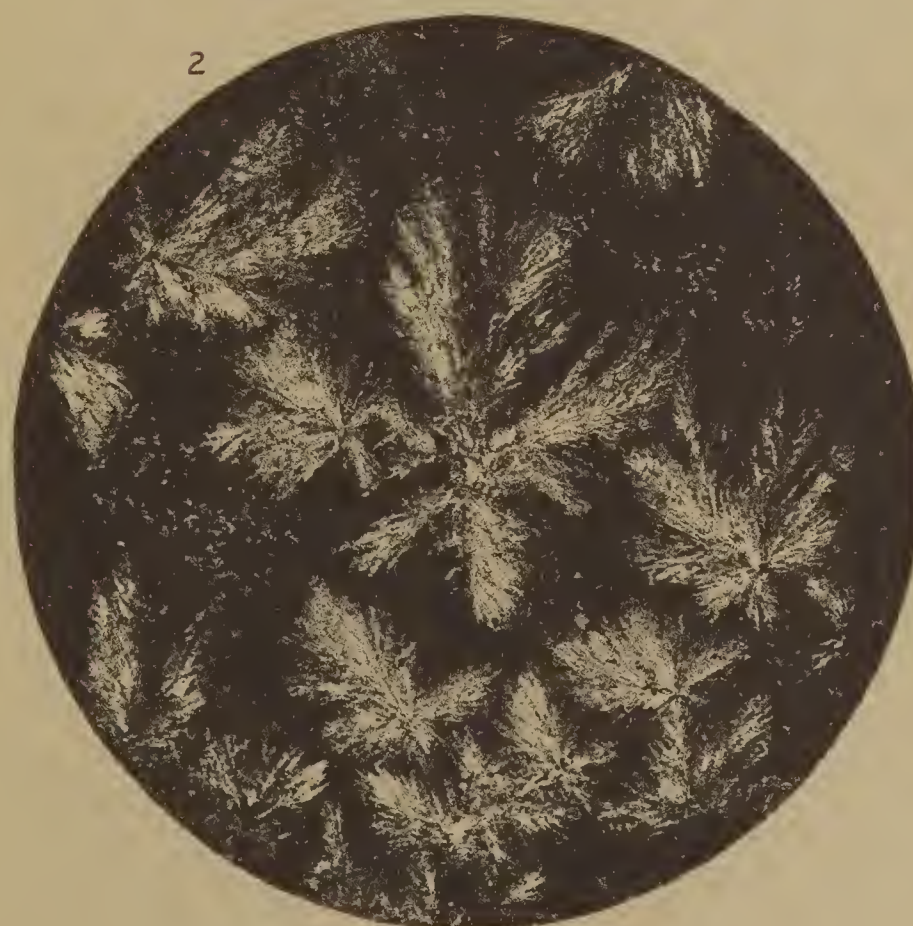
COCOA-NUT FAT CRYSTALS.



CARAPA FAT CRYSTALS.

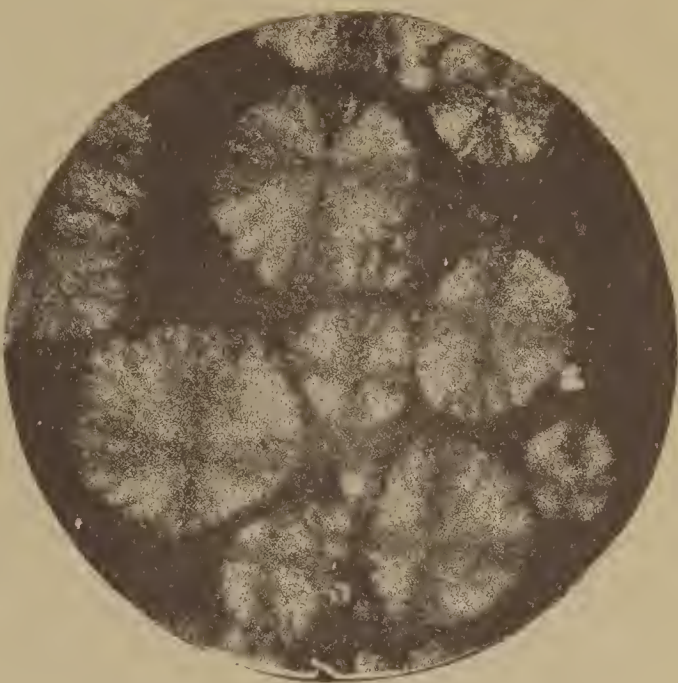
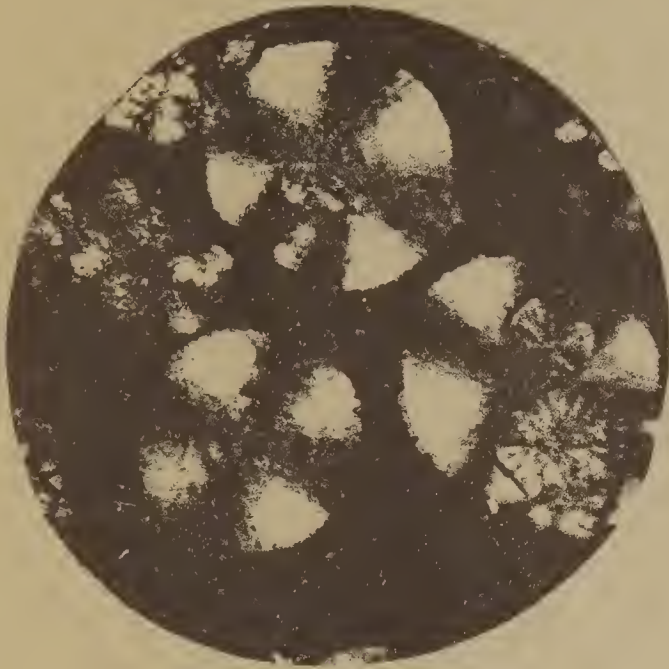


PALM FAT CRYSTALS.



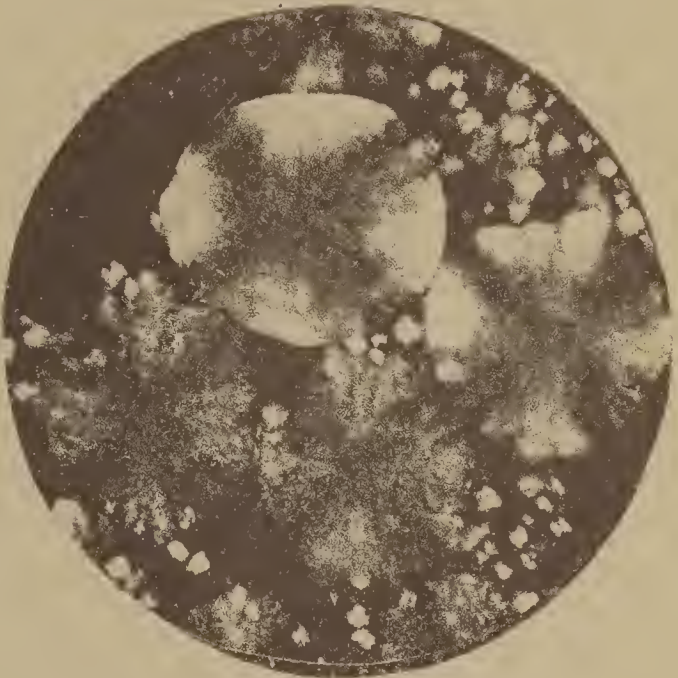
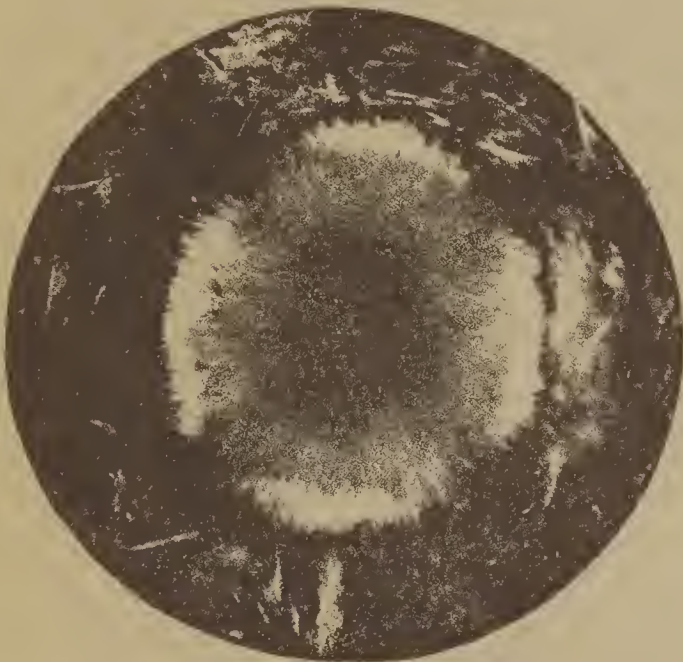
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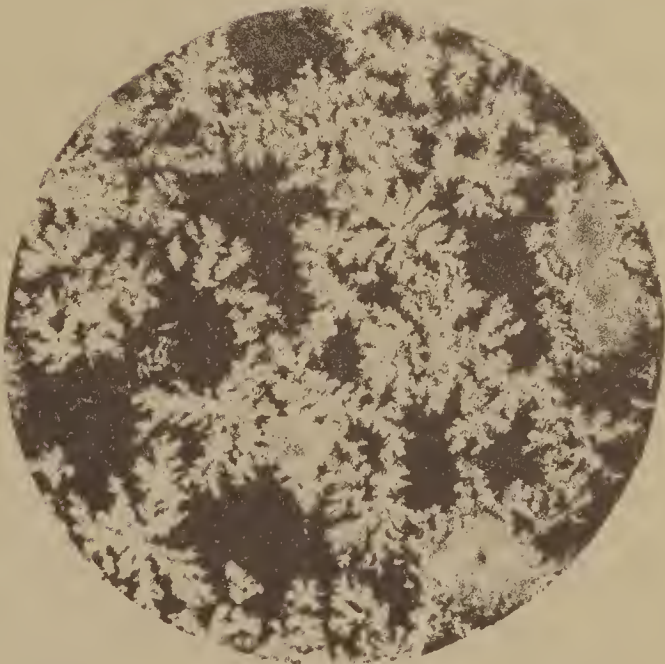
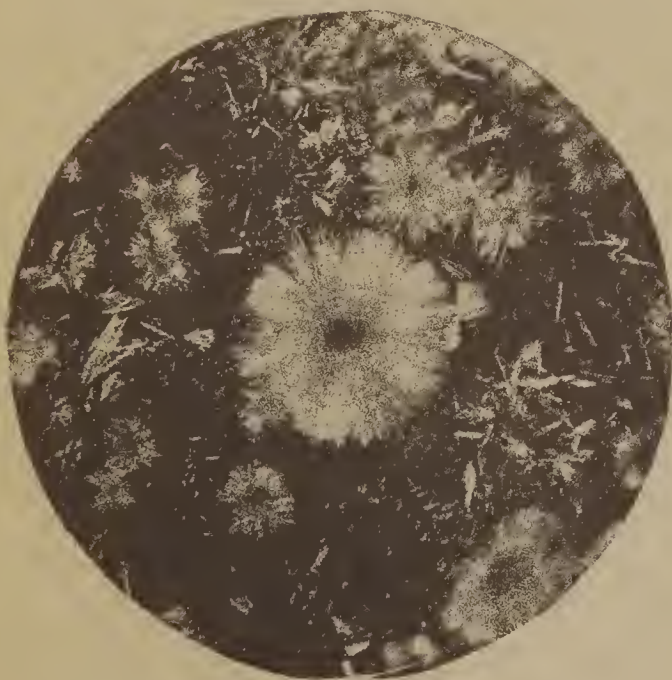
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6



1. 2. 4 COW'S BUTTER CRYSTALS.
3 MUSK-RAT FAT "
5 HUMAN "
6 MONKEY "



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